

# MAMMALOGY

---

Project title: **Fecundity and Fawn Mortality of Northern Yellowstone Pronghorn**

Principal investigator: Dr. John Byers  
Phone number: 703-306-1419  
Email: *jbyers@nsf.gov*  
Address: Department of Biological Sciences  
University of Idaho  
Moscow, ID 83844-3051

Additional investigators: Mary Robinson

**Objective:** The purpose of this research is to measure annual pregnancy rate, litter size, and litter mass of pronghorn females in Yellowstone National Park and to measure the death rate and ages at death of pronghorn fawns. This information is required to monitor the health and trend of this small, isolated pronghorn population and to estimate its likelihood of persistence over the long-term. This information is also critical for development of an intervention plan, should one become necessary, to save this indigenous population.

**Findings:** In February 1999 we contracted for the capture of 30 pronghorn females. Females were individually restrained using a net gun fired from a helicopter. Each female was fitted with a radio collar. In May-June 1999 we located females daily, or as frequently as possible, to record birth date and litter size. We captured fawns of these females and recorded mass. We attached solar-powered ear tag transmitters to some fawns. In June-August 1999 we located females daily, or as frequently as possible, to record estrus date.

Results from this first field season should be considered as preliminary. Seven radio-collared females died between February and May 1999. Of those, two were within 14 days post-capture and therefore may have been capture-related. Coyotes appear to have also played a role in at least one of the mortalities, but it is not known whether stress or minor injury (e.g., bruising) from recent capture predisposed that animal to predation. Five collared pronghorn died within the next three months, but all were more than 14 days post-capture and are therefore not considered capture-related. Of those five, two were known coyote predation, one was probable coyote predation, one was from lion predation, and one was from unknown causes (not enough remains were present to determine cause). Twenty of the 23 (87%) collared does were pregnant at the commencement of monitoring on May 17. Three does were neither pregnant nor lactating at the commencement of monitoring; it is unknown if they gave birth and lost their fawns soon thereafter or were not pregnant this summer.

The births of one single fawn (doe 193) and two sets of twins (does 224 and 374) were observed. This small sample is not sufficient to estimate litter size. We observed or inferred the existence of 23 fawns that were born to collared females. Five of these fawns were never seen, but their existence was inferred by lactation of the mother. Ten fawns (5 males and 5 females) of the 23 were captured, at 1-4 days of age. All captured were in good condition. Six fawns (26%) survived to the end of monitoring on October 7. Of the 17 that died, five were at uncertain age, but within the first three weeks of life. Of the remaining 12 deaths, five were within postnatal days 1-7, two within days 8-14, and three within days 15-21. Estrus dates were recorded between September 20 and October 2, with a peak at September 23 - 30.

Project title:	<b>Small Mammal Communities: Prey-Base for Carnivores</b>
Principal investigator:	Dr. Robert Crabtree
Phone number:	406-587-7758
Email:	<i>yes@yellowstone.org</i>
Address:	Y.E.S. P.O. Box 6640 Bozeman, MT 59771

Additional investigators: D. Despain, K. Wilson, K. Johnson

Objective: 1) Develop an inventory and monitoring method for small mammals (carnivore prey base) on Yellowstone's northern range. 2) Describe and quantify the effects of the 1988 fires on the small mammal community. 3) Quantify habitat use of the major small mammal prey. 4) Estimate abundance of major small mammal prey on the northern range according to major habitat types. 5) Collaborate with cooperating parties. 6) Continue long-term monitoring of small mammal populations, especially the major prey species.

Findings: Final report and book chapter have been completed. Various scientific publications are now being prepared. Significant effects of the 1988 fires have been documented. Dr. Kenneth Wilson of Colorado State University is currently working with PI to write three manuscripts for submission to scientific journals. Fieldwork was conducted in July and August to monitor small mammal populations in the Lamar Valley area.

Project title:           **Physiological Stress Responses, Aggression and Social Dominance in Free Ranging Wolves**

Principal investigator:   Dr. Scott Creel  
Phone number:           406-994-7033  
Email:                    *screel@montana.edu*  
Address:                 Biology Department  
                              Montana State University  
                              Bozeman, MT 59717

Additional investigators:   Jennifer Sands

Objective: 1) Determine factors that affect stress hormone levels in free-ranging wolves. This includes behavioral, ecological, and anthropogenic influences. 2) Relate stress physiology to survival and reproduction. 3) Relate stress physiology to social status.

Findings: We conducted our first full season of field research in the winter of 1998-1999. We have collected approximately 200 fecal samples since January 1999 from both known individuals, and where this was not possible, known pack. We have collected 100+ hours of observations of wolves that we are beginning to analyze for rates of aggressive interactions and dominance relationships. Our research has focused on the Druid, Rose Creek and Leopold packs in the northern range of the park. We have finished running the glucocorticoid radioimmunoassays of the fecal samples collected last field season and are beginning to analyze this data. We will also run radioimmunoassays for sex steroids (estrogen, estradiol, and testosterone) beginning this spring. Our second field season began January 15, 2000, and we intend to continue fieldwork through May and return next fall during the intensive wolf winter study in November 2000.

Project title:           **Grizzly Bear Behavior, Genetics and Ecology**

Principal investigator:   Dr. Steven French  
Phone number:           307-789-7636  
Email:                    *mfrench@wyoming.com*  
Address:                 6675 Upper Cascades Drive  
                              Jackson, WY 83001

Additional investigators:   Marilyn G. French

Objective: The threatened Yellowstone grizzly bear represents a bellwether population for many other endangered species of predators. The successful long-term conservation of this population requires two crucial pieces of data: managers need to know the number of grizzly bears in the ecosystem, and they need an accurate assessment of the population trend over time. They also need to ensure that the population does not suffer from a loss of genetic diversity. Our project is designed to apply the tech-

niques of molecular genetics to aid the conservation of grizzly bears in the Yellowstone ecosystem. The primary aims of the project are to assess the degree of genetic diversity in the Yellowstone population, and to use molecular techniques to develop a non-invasive system to accurately monitor the number of grizzly bears in the ecosystem.

Findings: We have completed the development of 35 nuclear DNA micro-satellites for Yellowstone Grizzly Bears. A total of 195 grizzly bear DNA samples have been genotyped using these loci. We have also compared the genetic diversity among bears from Banff, NCDE, Yellowstone, and Kodiak using these loci. Two manuscripts are in preparation for scientific publication. Once accepted, the results, including technical data for the loci and the primus, will be released to the general public via the Internet. Hard copies of the manuscripts will be sent to interested parties.

Project title:           **Development of Aerial Survey Methodology for Bison  
Population Estimation in Yellowstone National Park**

Principal investigator:   Dr. Robert Garrott  
Phone number:           406-994-2270  
Email:                    *rgarrott@montana.edu*  
Address:                 Montana State University  
                              Department of Biology  
                              310 Lewis Hall  
                              Bozeman, MT 59717

Additional investigators:   Steven C. Hess, L. Lee Eberhardt

Objective: The overall objective of this study is the development of aerial survey methodologies for statistically rigorous estimation of the bison population in the Yellowstone area that will have sufficient power and precision to detect demographic trends. These methodologies will allow NPS resource managers to conduct aerial surveys that provide scientifically defensible population estimates to address ecological conditions and epidemiological management issues of Yellowstone bison.

Findings: The survey methodology we are developing quantifies a sampling universe and sampling units with computer geographic information system, standardizes search effort, employs a stratified sampling design which accounts for undetected animals, and uses an aircraft global positioning system to record data locations. Including seasonally occupied areas outside YNP boundaries, 76 survey units with area of 2,339 km<sup>2</sup> comprise the entirety of our designated survey extent, roughly equivalent to 26% of the area of YNP. The same survey units and total extent are used both in winter and in summer, but survey units have different strata designations for each season. During winter, 52% of the entire survey area is designated to be in the high density stratum, while in summer, 41% of this area is in the high density stratum. For this research, we enumerated all survey units in the seasonal high density stratum. During our 1998 winter and summer field seasons, we completed 17 flights totaling 56.4 hours of bison surveys, not including ferry time. During our 1999 field seasons, we completed 16 flights totaling 49.6 hours.

Concurrent intensive ground surveys, or “double sampling,” in the Madison-Gibbon-Firehole areas in winter were used to estimate the magnitude and variability in detectability during specific aerial surveys. In comparing these simultaneous ground and aerial surveys primarily in winter, only 84.3% of the groups were detected from aircraft, although 94.8% of individual bison were detected. During the summer breeding period, as much as 70% of the entire bison population is aggregated in significantly larger, highly visible groups in Hayden Valley than observed during winter. Conducting surveys during this time may provide for both higher detectability of groups and smaller spatial extent than in winter, when bison occupy a larger area and occupy thermal habitats which have unfavorable background color. We found detectability to be relatively high in comparison to aerial surveys of other species, although many small groups and solitary bison were not detected from aircraft, which biases population estimates downward. Low variability between counts and high detectability suggest that precise and unbiased population estimates should be readily obtainable.

Project title:           **Some Population Characteristics of the Yellowstone National Park Bison Herd, 1996-20001**

Principal investigator:   Dr. Peter Gogan  
Phone number:           406-994-6989  
Email:                    pgogan@montana.edu  
Address:                 USGS-BRD  
                              Department of Biology  
                              Montana State University  
                              Bozeman, MT 59717

Additional investigators:   Wendy E. Clark, Edward M. Olexa, John A. Mack

Objective: To determine basic population parameters of Yellowstone National Park bison herd.

Findings: Samples were secured opportunistically from bison slaughtered beyond the boundaries of YNP during the winter of 1996-97. We found marked differences in the age structure of bison killed in the vicinity of West Yellowstone and Gardiner. This difference is likely attributable to largely non-selective removals at West Yellowstone and selective removals at Gardiner. Pregnancy rates increased continuously between one and six years of age. Cross-referencing of our age data with Montana Department of Livestock seroprevalence data revealed a general upward trend in seroprevalence with age for female bison. Our sample of male bison was too limited for this comparison.

We secured samples from 69 of the 87 (79%) slaughtered in the vicinity of West Yellowstone in the winter 1998-1999. Data on these bison were gathered in cooperation with the Montana Department of Livestock and USDA's APHIS. Sampled bison ranged in age from 1 to 11 years old. With the exception of a single eight-year-old, all sampled females were pregnant.

Project title:           **Ecological Status of Mule Deer of the Northern Yellowstone Winter Range**

Principal investigator:   Dr. Peter Gogan  
Phone number:           See previous entry

Additional investigators:   Edward Olexa, Tom Lemke

Objective: 1) Determine the summer ranges of deer utilizing the northern winter range. 2) Determine use patterns of deer on the northern winter range. 3) Determine annual reproductive performance and fawn survival. 4) Determine numbers, age, and sex structure of the wintering herd.

Findings: This study has been conducted under the auspices of the Northern Yellowstone Cooperative Wildlife Working Group. Sixty adult doe mule deer were net-gunned and radio-collared on the northern range in March 1993. An additional 25 adult does were captured and radio-collared in March 1995. Animals were located from a fixed-wing aircraft at approximately 10-day intervals between April 1993 and May 1997. Locations were determined with a GPS unit in the aircraft. Age and sex composition counts were completed in early winter and total counts and adult:fawn ratios were completed in May of each year.

Radio-tracking data reveal that mule deer wintering in the Gardiner Basin on the east side of the Yellowstone River summer to the east of the winter range with one exception. Some deer wintering in the Slip 'n Slide drainage moved to the west to the vicinity of Big Sky, Montana. Similarly, deer wintering on the west side of the Yellowstone River summer to the southwest of the winter range. Data on the age and sex composition for the period of study have been combined with previously published information to track population trends. Analysis reveals that fawn survival is closely linked to an index of winter severity, particularly to snow water equivalency.

Project title:           **Seasonal Movements and Habitat Selection by Bison in YNP**

Principal investigator:   Dr. Peter Gogan  
Phone number:           See previous entry

Additional investigators:   Edward M. Olexa, John Mack

Objective: To determine movement patterns of YNP bison and relate these movements to range conditions such as herbaceous standing crop, growth stage, snow depth, and snow water equivalency in the areas vacated and occupied by bison.

Findings: Forty-five bison were net-gunned and radio-collared in October 1997. An additional 40 bison were radio-collared as part of on-going epidemiological studies of bison and brucellosis. Five bull bison were net-gunned and radio-collared on the northern range in March 1998. Aerial radio-tracking flights

for all instrumented bison have been on-going since that time. Bison are being relocated at approximately 10-day intervals. Locations are being determined with a differentially correcting GPS unit in the aircraft.

Thirty of the original 45 instrumented bison were recaptured and fitted with improved radio collars in October 1998. Eighty-three bison were being radio-tracked at that time. We were radio-tracking 64 bison by October 1999. Since the inception of the study, there have been 25 known mortalities, 12 bison that lost their collars, and four bison that either shed their collars or died.

Project title:           **Monitoring the Response of Small Mammal Communities to Climatic Change Using Raptor Pellets**

Principal investigator:   Dr. Elizabeth Hadly  
Phone number:           650-725-2655  
Email:                   *hadly@stanford.edu*  
Address:                 Stanford University  
                              Department of Biological Science  
                              P.O. Box 5020  
                              Stanford, CA 94309-5020

Additional investigators:   April Craighead

Objective: The objective of this project was to establish roosting and nesting sites of common raptors in different habitats within Yellowstone National Park. Pellets were collected and analyzed to determine prey species in the diets of these raptors. The species within the pellets will then be analyzed to determine whether specific habitats can be determined using certain raptor pellets.

Findings: During the field seasons of 1998-99, 1,240 raptor pellets were collected from six different species of raptors, and 52 coyote scats were collected from four distinct habitats within Yellowstone National Park. These habitats included xeric grass/shrublands to mesic grasslands.

Analysis of 700 pellets and 52 scats indicate the diet of these animals is quite diverse, and includes rodents, birds, amphibians, snakes, and insects. The most common species in the pellets and scats include voles (*Microtus spp.*), northern pocket gophers (*Thomomys talpoides*), deer mice (*Peromyscus maniculatus*) and Uinta ground squirrels (*Spermophilus armatus*). Repository of this collection will be at Stanford University in California.

Project title: **Bat Survey Along the Madison-Norris Road Corridor**

Principal investigator: Dr. Paul Hendricks  
Phone number: 406-543-0995  
Email: *phendricks@state.mt.us*  
Address: Montana Natural Heritage Program  
909 Locust Street  
Missoula, MT 59802

Additional investigators: Roy Renkin

Objective: The objective was to document bat activity along the road corridor between Norris Junction and Madison Junction in Yellowstone National Park. Sites to be inspected and monitored included: 1) bridges; 2) selected thermal areas; and 3) wetland, forest, and cliff sites. Mist-net trapping and overnight monitoring with electronic bat detectors were part of the sampling scheme.

Findings: Results have not been analyzed, so these findings are preliminary. Six bridges along or over the Gibbon River were inspected for evidence of use by bats. Three bridges contained guano accumulations. The bridge at Madison Junction is not suitable for use by bats; the remaining five structures could be used. Sites under bridges used included exposed steel beams adjacent to concrete or stone pilings. Few sites were mist-netted, and only one bat (a male little brown *Myotis*) was captured. Twenty-one sites were monitored overnight with bat detectors. Of these, bat activity was detected at 17 sites. Bats were also monitored one evening at Norris Campground. At least two species were actively foraging at treetop (30-40 ft above ground), beginning at 19:40 and continuing until monitoring ceased (21:15). Activity diminished quickly as temperature dropped. More bats undoubtedly use the road corridor than these results indicate. Fieldwork was conducted from September 20-25, when many bats had probably already left the park.

Project title: **The Dietary and Foraging Ecology of the Yellowstone River Otter: An Umbrella Species for Aquatic Systems**

Principal investigator: Dr. Douglas Kelt  
Phone number: 530-754-9481  
Email: *dakelt@ucdavis.edu*  
Address: Department of Wildlife, Fish, and Conservation Biology  
University of California, Davis  
One Shields Avenue  
Davis, CA 95616

Additional investigators: Bill Wengeler, Nathan Varley

Objective: We propose to clarify the ecological role of native vs. non-native fish species on



Yellowstone river otters by comparing otter populations on two lake systems in YNP: Yellowstone Lake, where the native cutthroat population is still healthy, and the Lewis-Shoshone Lake complex, in which non-native fish, primarily lake trout and brown trout, predominate. Specifically, we intend to characterize river otter diets through fecal analysis and document otter foraging habits by observing daily activity patterns. Furthermore, we are currently considering the use of stable isotope analysis to determine the trophic levels at which otters and their prey exist. The data generated by this research will help assess the consequences of the lake trout invasion on a predator whose existence is firmly linked to aquatic systems and may prove critical to the future management of Yellowstone waters.

**Findings:** This project began in the summer of 1999 with surveys for otter sign, scat collection, and the acquisition of fish samples (lake, brown, and cutthroat trout of various age/size classes) from park biologists. The fish samples have been prepared for purposes of establishing reference collections with which to compare otter fecal contents. Approximately 100 river otter fecal samples were collected between August and November. We are currently analyzing fecal samples in the lab and characterizing otter diet by the frequency of occurrence of various prey items. Numbers of prey items, prey species, and size are estimated on the basis of otoliths, vertebrae, and other appropriate skeletal structures. Pending permit approval, collection of samples will resume in January 2000. Specimens will be housed at the U.C. Davis anthropology museum.

Project title:           **Impact of Wolf Reintroductions on the Foraging Efficiency of Elk and Bison**

Principal investigator:   Dr. John Laundre  
Phone number:           208-236-3914  
Email:                    *launjohn@isu.edu*  
Address:                  Department of Biological Sciences  
                                PO Box 8007  
                                Idaho State University  
                                Pocatello, ID 83209

Additional investigators:   Lucina Hernandez

**Objective:** Determine what impacts the reintroduction of wolves might have on the foraging efficiency and thus, the survival of elk and bison in Yellowstone National Park.

**Findings:** During 1999, 250 feeding bouts by elk and bison were observed. Of these, approximately half were in the area where wolves currently occur and the other half in areas where wolves have yet to establish. In both areas, the observation bouts were equally divided among males, females with calves, and females without calves. Results of analysis of the data for 1996 indicated that female elk with calves and females without calves foraged significantly less and surveyed significantly more in the area where wolves were. There was no difference for males. Data from 1997 indicated the same significant differences for females. Additionally, both female groups foraged significantly less and surveyed signifi-

cantly more in areas with wolves in 1997 over their 1996 rates. Additionally, females with calves spend even less time feeding and more time observing than females without calves. Analysis of data from 1998 indicate a similar pattern as found for 1997. This suggests that elk in wolf areas stabilized their level of vigilance.

In 1998, data were also collected on the vigilance of bison in wolf and non wolf areas. Results of those data indicate that bison too, are responding to the presence of wolves with a similar pattern: no response by males, an intermediate response by females without calves and the greatest response by females with calves. Data were also collected on the distribution of pellet groups (elk) and fecal piles (bison) relative to the distance from forest edges. Preliminary analyses for areas with wolves indicate that significantly fewer elk pellet groups were found in open areas greater than 300 meters from forest edges. This pattern was not found in non-wolf areas. A similar trend was seen in the 1999 data. Thus, elk seem to be responding to the presence of wolves by shifting their habitat use while we have not seen this effect in bison. Analysis of fecal nitrogen, phosphorous, and protein in elk indicates significantly lower levels of these components in the diets of elk from areas with wolves. No difference was seen in the diets of bison. Thus, elk seem to be consuming a poorer diet in wolf areas vs. non wolf areas.

Research efforts this year will be to determine if the patterns of vigilance are consistent over another year. This year's data collection could allow before and after comparisons in areas where wolves weren't before but have subsequently become established. We will also collect more data on the distribution of elk and bison relative to forest edge and diet quality in wolf and non-wolf areas.

Project title: **Winter Bison Monitoring**

Principal investigator: Yellowstone Bison Management Office

Phone number: 307-344-2213

Email: *Gregg\_Kurz@nps.gov*

Address: P.O. Box 168  
Bison Management Office  
Yellowstone National Park, WY 82190

Additional investigators: Yellowstone National Park personnel

Objective: The objective of this monitoring effort is to determine bison location, movement and use of the Fishing Bridge to Canyon and Mammoth to Gibbon Falls road segments, as well as the surrounding area along the road corridors during the winter of 1998-99.

Findings: Each of the road segments was monitored from December 8 through mid-March with a combination of ground surveys, photo-points, and aerial surveys. A total of 64 ground surveys were completed in each study area. A total of 2,458 bison group observations were recorded during this period. Of the 2,458 observations, 5.8% (58) in Mammoth and 9.4% (137) in Hayden Valley were documented on the roads, as compared to 2% (26) in Hayden in 1997-98. Aerial survey results indi-

cated that the number of bison remained fairly stable in both study areas between December and February. Bison numbers changed substantially, however, during the month of March, more than doubling in the Mammoth study area and decreasing by nearly 25% in the Hayden study area. A total of 2,299 pictures were taken, 8% (184) recording bison. Of the 184 sightings, 8% (14) were of bison on the groomed road surface.

Project title:           **The Effect of Environmental Variability on Grizzly Bear Habitat Use**

Principal investigator:   Doug Ouren  
Phone number:           406-994-4760  
Email:                    ouren@montana.edu  
Address:                 USGS Northern Rocky Mountain Science Center  
Interagency Grizzly Bear Study Team  
Forestry Science Lab  
Montana State University  
Bozeman, MT 59716

Additional investigators:   Robert Garrott, Charles Schwartz, Steve Cherry, Richard Aspinall

Objective: The overall design of this project is to utilize existing data, expertise, and newly collected data from advanced technologies to evaluate the impact of anthropomorphic influences on grizzly bear (*Ursus arctos horribilis*) habitat selection. Initially, this study will have three areas of emphasis: 1) impact of motorized and non-motorized trails on grizzly bear habitat selection; 2) habitat selection by grizzly bears within Yellowstone National Park versus those outside of the Yellowstone National Park; 3) similarities and dissimilarities in delineating grizzly bear home ranges when collecting locational information with different technologies.

Findings: The first year objective of this project was to deploy Global Positioning System (GPS) collars on grizzly bears in northern and northwestern portions of the Yellowstone National Park and surrounding Forest Service land making up the study area. The collars selected for this project were Advanced Telemetry System collars instrumented with GPS receivers and very high frequency (VHF) transmitters.

The main advantages to collars with the GPS technology are safety to researchers, minimized handling of each bear, and the amount of information gained on habitat use. After the GPS collar has been placed on the bear, locational information is automatically gathered on a predetermined schedule, without any intervention of the researcher. For the initial data collection period, the collars were programmed to collect locations every seven hours. Thus, there was a potential of collecting a minimum of three locations each day as compared to VHF technologies where researchers have gotten a location approximately once every ten days. The collars were also instrumented with remote release devices designed to release without handling the bear a second time. Once the collar had been dropped, VHF receivers were used to locate and retrieve the collars.

For this study the IGBST was able to instrument 12 bears during the 1999 season. Of the 12 grizzly bears collared, five were adult females and seven were adult males. The first collar was deployed on May 6, 1999, and the last collar was deployed on August 12, 1999. These collars collected data throughout the non-denning season before they were remotely released. Collars ranged in success of location acquisition rate from a high of 48% to a low of 7.2%. In the following years the researchers hope this rate will increase to above 65% by changing collar design. Next year the researchers plan to use a collar that will stay on for 12 months and record locations during the non-denning months (April 15 through November 15) at a rate of four locations per day. This collar will automatically drop off at the end of the 12 month period. In addition to the collection information on grizzly bears, the researchers will be updating the current grizzly bear habitat with current satellite imagery.

Project title: **Population Dynamics of the Yellowstone Grizzly Bear**

Principal investigator: Dr. Charles Schwartz  
Phone number: 406-994-5043  
Email: *ccs@montana.edu*  
Address: Interagency Grizzly Bear Study Team  
Forestry Sciences Lab  
P.O. Box 172780  
Montana State University  
Bozeman, MT 59716

Additional investigators: Mark Haroldson

Objective: To describe the population trend from threatened status to recovery and approximate stability.

Findings: These data include information collected by the Interagency Grizzly Bear Study Team for the entire Greater Yellowstone Area. Data obtained within YNP is not broken out separately. Forty-two individual grizzly bears were captured 47 times during the 1999 field season. Sixteen captures of 15 bears were the result of management actions. Thirteen of these instances resulted in relocation of the nuisance bear(s). A total of 1,109 aerial radio locations were obtained on 65 individual grizzly bears radio-monitored during all or some portion of 1999. Nineteen of these bears were adult females. Two rounds of observation flights were conducted as part of a capture-mark-resight experiment. Flights covered the entire grizzly bear recovery zone plus a 10-mile perimeter. The first round of flights began June 7. Forty bears, none of which were radio-marked, were observed during 79.6 hours of flying. Twenty-nine radio-marked bears were available for observation within survey units. The second round of flights began on July 8, and 45 bears, including one marked individual, were observed during 74.5 hours of flying. Thirty-one marked bears were located within survey units. Thirty-three unduplicated females with cubs of the year were identified during 1999. Three of these unique females were initially observed outside the grizzly bear recovery zone; one of the three was initially observed outside the 10-

mile perimeter. A total of 63 cubs were observed during the initial sightings of these females. Eleven single cub litters, 17 litters of twins, and 9 litters of triplets were observed. Mean litter size was 1.9. Females with young (cubs, yearlings, or 2-year-olds) were observed in 17 of 18 Bear Management Units within the grizzly bear recovery zone. We documented six known and one probable human-caused grizzly bear mortalities during 1999. One management removal occurred more than 10 miles from the boundary of the grizzly bear recovery zone. Two known and four probable mortalities of cubs were also documented. One radio collared bear was found dead from unknown causes. Yellowstone Grizzly Bear Investigations for 1995-1998 are now available at: [www.mesc.usgs.gov/yellowstone/IGBST-home.htm](http://www.mesc.usgs.gov/yellowstone/IGBST-home.htm). The 1999 annual report will be available by May 2000.

Project title:	<b>Food Habits and Habitat Use of the Yellowstone Grizzly Bear</b>
Principal investigator:	Dr. Charles Schwartz
Phone number:	See previous entry
Additional investigators:	Mark Haroldson, Shannon Podruzny, Doug Ouren

Objective: To determine habitat requirements for the Yellowstone grizzly bear and to document its return to free-ranging status.

Findings: Surveys to determine an index of spring ungulate carcass availability were conducted during May. Approximately 300 km of transect routes were surveyed in four different ungulate wintering areas. We observed 0.25 ungulate carcasses/km. A relatively small number of winter killed ungulates were available to bears during the spring of 1999. Surveys of numbers of spawning cutthroat trout and their use by grizzly bears were conducted from mid-May to early August on tributary streams to Yellowstone Lake. Spawner numbers were high in most streams surveyed except those in the West Thumb area. Three hundred and eighty-six hair samples suitable for DNA analysis were collected near spawning streams. These samples will be used to estimate of the number of individual grizzly bears that fish for spawning cutthroat trout. Surveys of 19 whitebark pine cone productivity transects were completed during July. The number of mean cones per tree was 39.5. This was the second highest average since the whitebark pine cone production transects were initiated in 1980. A total of 152 grizzly bear observations were recorded at 26 known and/or suspected insect aggregation sites during late July through September of 1999. One hundred and fifty-one scats were collected and will be analyzed to identify food items used. Yellowstone grizzly bear investigations for 1995-1998 are now available at: [www.mesc.usgs.gov/yellowstone/IGBST-home.htm](http://www.mesc.usgs.gov/yellowstone/IGBST-home.htm). The 1999 annual report will be available by May 2000.